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## PARADOXES OF COMPETITION.

ECONOMIC terms seem to pass in their historical development through a series of stages which, without pretension to rigidness, may be described as follows: first, no definition is given, but it is assumed that every one has a sufficiently clear idea of the subject to make a formal definition unnecessary; second, a definition is attempted and a number of exceptional forms are noted; third, with the further increase of data, the relative importance of the various forms changes, confusion in discussion is introduced, logomachy takes the place of constructive investigation; fourth, a complete classification of the forms embraced under the original term is made, and problems are investigated with reference to these classes. The bewildering vagueness of economic theory is largely due to the fact that the terms used are in all of these stages of development.

Perfect competition is the fundamental hypothesis of economics in the sense that perfect competition is postulated in nearly every argument as to economic equilibrium. How far has the analysis of this term proceeded towards definiteness and precision? It would not be difficult to show that the assumption of sufficient clearness for practical and theoretical purposes is all too common in the contemporary treatment of the ultimate hypothesis of the science. In what respect is the idea of competition changed when the modifiers "perfect," "unlimited," "indefinite," "free," "pure," are added? If by these additions there is a change of meaning in the term, then, in cases in which the state of industry admits only of competition, what is the nature of the limitation of the

applicability of propositions deduced under the hypothesis of perfect competition? The almost invariable answer to this last question is that the imperfection of competition is simply a form of friction, producing, for the most part, a negligible variation from the standards that prevail in a régime of perfect competition. It is hoped that this paper may be a cause for a more careful scrutiny of this complacent answer.

The objects of the paper are threefold: (a) To present a series of paradoxes having their origin in the shifting meaning of the term "competition." (b) To mark the vicious fallacy—perhaps the most subtle and damaging of the many that pervade contemporary economics—of projecting into an unexplored territory the method of reasoning relative to a definite state of industry and a given series of implicit hypotheses. This point is enforced by a consideration of the doctrine that, as wages, the laborer gets what he produces. It is suggested that in the present state of economic knowledge, with the present method of economic reasoning, all that can be said of actual wages is that the laborer at least produces what he gets. (c) To indicate the need of a more precise definition of terms, a more careful formulation of the premises of our reasoning, and the imperative necessity of a statistical knowledge of the conditions of production and of the ownership of property.

## I.

Some of the associations of the term "competition" should first be considered. It is quite true that "the strict meaning of competition" is "the racing of one person against another, with special reference to bidding for the sale or purchase of anything";<sup>1</sup> but that is not its full meaning when the proposition is deduced that under a régime of

<sup>1</sup> Marshall, *Principles*, p. 5, 4th edition.

competition the laborer gets what he produces. When competition is made the fundamental hypothesis in reasoning with regard to economic equilibrium, it takes on a more complex connotation, no matter whether the method of investigation employed is the common form of *caeteris paribus* of the older economists, the static state or statical method of the more recent deductive economists, or the system of simultaneous equations of the mathematical economists. In all these cases, competition is a blanket-term covering more or less completely at least the following implicit hypotheses:—

I. Every economic factor seeks a maximum net income. This is the essential meaning of the term.<sup>1</sup> It is made the basis of the definition of the science given by Professor Edgeworth: "Economics investigates the arrangements between agents each tending to his own maximum utility."<sup>2</sup> This aspect of competition is always explicitly emphasized in those systems of economics using analytical symbols, since it at once suggests that, as Malthus fore-saw, "many of the questions, both in morals and politics, seem to be of the nature of the problems *de maximis et minimis* in Fluxions."<sup>3</sup> It is the prime hypothesis used in the system of Cournot: "Nous n'invoquerons qu'un seul axiome, ou, si l'on veut, nous n'employerons qu'une hypothèse savoir que chacun cherche à tirer de sa chose ou de son travail la plus grande valeur possible."<sup>4</sup> It may be called the maximum hypothesis of competition.

<sup>1</sup>"It is to Quesnay in his *Dialogues sur les travaux des artisans* that we owe the first, and very categorical enunciation of the formula which has been so famous under the name of the edonistic (?) principle, and constitutes, in fact, the basis of economics: 'To obtain the greatest possible increase of enjoyment with the greatest decrease of expense is the perfection of economics.' It is no exaggeration to say that he who enunciated this principle has indeed a right to the title of Founder of Economic Science." Gide's review of Higgs's *Physiocrats, Economic Journal*, June, 1897, p. 248.

<sup>2</sup> *Mathematical Psychics*, p. 6.

<sup>3</sup> *Observations on the Effects of the Corn Laws*, 1814, p. 30.

<sup>4</sup> *Recherches*, p. 46.

II. There is but one price for commodities of the same quality in the same market. This is Jevons's law of indifference, constantly used as a premise in his theory of economic equilibrium. It is also used by Cournot, notwithstanding the above statement that he would invoke but a single axiom: "Il ne peut pas y avoir dans une ordre de chose stable, et sur une grande échelle, deux prix différents pour une même quantité débitée."<sup>1</sup> As an illustration of the identification of this hypothesis with competition, a passage from Jevons's *Principles of Economics* may be cited: "This law of indifference, in fact, is but another name for the principle of competition which underlies the whole mechanism of society" (p. 60).

III. The influence of the product of any one producer upon the price per unit of the total product is negligible.

Compare, for an illustration, Professor Pareto's *Cours d'économie politique*, vol. i. p. 20: "L'échangeur subit les prix du marché sans essayer de les modifier de propos délibéré. Ces prix sont modifiés effectivement par son offre et sa demande, mais c'est à son insu. C'est ce qui caractérise l'état que nous appelons de libre concurrence. . . . En langage mathématique nous dirons que pour établir les conditions du maximum, on différentie en supposant les prix constants."

IV. The output of any one producer is negligible as compared with the total output. Professor Marshall has discussed this assumption in Note XIV. of the Appendix to his *Principles*, particularly p. 801 of the 4th edition.

V. Each producer orders the amount of his output without regard to the effect of his act upon the conduct of his competitors. Where III. and IV. coexist, V. is a simple corollary, otherwise it is an independent and inadmissible hypothesis. This fact should be carefully observed, as much of the subsequent reasoning is based upon it. In most systems of economics a theory of distribu-

<sup>1</sup> *Recherches*, p. 73.

tion is developed by reasoning consciously from hypotheses I. and V. It is not, however, by any means always perceived that the truth of the theory is further limited by the implicit assumption of hypotheses II., III., and IV. This loose method of procedure entails no necessary harm so long as the investigation is confined to a simplified hypothetical state, but great harm is done when, in approaching the problems of actual industry,—which, to a large extent, is in a state intermediate between perfect monopoly and perfect competition,—the economist flings the inquirer into the vague with the assurance that static standards will tend to prevail. In this intermediate state between perfect monopoly and perfect competition, hypotheses III. and IV. are never true, and hypothesis II. is frequently untrue.

A series of objections to the above listing of the implications of perfect competition may easily be imagined. It may be said, for example, that these are not all of the hypotheses that are consciously or unconsciously drawn into reasoning when the term "perfect competition" is used. This objection would simply indicate the more the confused state in which actual discussion is conducted. It may also be said that some of the hypotheses are corollaries under special conditions of the fundamental meaning of the term "competition." This will likewise be admitted, but with insistence upon the above statement, that all of the hypotheses are frequently subsumed under the one term "competition." It may be further objected that, in the enumeration of the above characteristics, perfect competition is confused with a perfect market. To this it may be replied that the confusion exists in current economics; that a perfect market is less frequently defined than perfect competition, and that there is room for maintaining that a perfect market is one in which competition is perfect.

## II.

The paradoxes about to be presented have their origin in the shifting meaning of the term "competition" according as it embraces all or only a part of the above five hypotheses. The methodological fallacy which it is wished to mark consists in the extension of the method of reasoning relative to perfect competition, in the sense of the five hypotheses, into territories where only a part of the five hypotheses obtain, and in the projection of propositions relative to a state of industry described by the five hypotheses into conditions where competition exists only in its essential and fundamental meaning.

Suppose it is proved, under the hypothesis of perfect competition, that labor gets exactly what it produces.<sup>1</sup> Suppose, further, that, in consequence of a perfect monopoly of a particular industry, the price of the commodity produced has risen, and wages have fallen, thus affecting both consumers and labor. What would be the significance of a proposed remedy of these evils of monopoly in the form of competition, potential or actual? If there should be two or more competing producers instead of one monopolist, would their competition either remove or reduce the evils of monopoly? Exactly what is the meaning here of competition? It is not that the influence of the product of each producer upon price is negligible, nor that his product is small as compared with the total output. Besides, competition, in the strict and fundamental use of the word, may be of the keenest, and yet labor would get what it could, and price would not necessarily fall to

<sup>1</sup> There is a persuasive quality about these terms that is extremely unfavorable to the progress of inquiry in the field of wages. Quite frequently from "labor gets what it produces" the inference is drawn that labor gets all it should. A more just wording would be that labor gets what the assumed property rights and assumed organization of industry make possible, and the important question is not so much whether labor gets what it produces under those conditions, but rather why actual conditions make possible so small a product.

the level of perfect competition. If under perfect competition it is true that labor gets what it produces, then, when competition is only between a few producers, all that can be said is that labor, at least, produces what it gets.

This proposition should be examined in greater detail. We may approach the question by following a route that has been traversed by some of the ablest investigators who have explored the devious ways of economic theory. In the seventh chapter of Cournot's *Recherches sur les principes mathématiques de la théorie des richesses* two propositions of greatest theoretical interest are deduced. We shall at present take up the first. The chapter bears the heading "De la concurrence des producteurs." The use this pathfinder makes of the term "competition" should be noted, particularly as his Chapter VIII. bears the title "De la concurrence indéfinie." The first proposition is announced as a result of the solution of a problem that may be stated as follows: Suppose there are two owners of two mineral springs supplying a water that has no cost of production. If the owners compete instead of forming a monopoly, what will be the price of the water as compared with the price under monopoly, and what will be the condition of equilibrium? Cournot's answers are:—

- (1) The price will be lower than the monopoly price and higher than the price under perfect competition;
- (2) The amount of water supplied will be greater than the amount supplied under perfect monopoly;
- (3) Stable equilibrium will obtain.

It is very doubtful whether these conclusions are regarded as more than platitudes to most readers of Cournot's classic. They are rather concerned to understand why Cournot should have resorted to the differential calculus to prove what, without its use, they already know. Cournot was quite aware of the certainty of this objection.

("Comme on est bien convaincu avant toute analyse le résultat de la concurrence est d'abaisser les prix," p. 94.) If his method of treating the question should, perchance, stimulate interest, it is probably, in most cases, because it is regarded as establishing what Von Thünen called "eine mathematisch sichere Grundlage."

Let us look into the history of this platitudinous "mathematisch sichere Grundlage" of pure economics. As is well known, the work of Cournot, published in 1838, was not reviewed in France until, in reply to the reproach of Professor Walras that the French had ignored their greatest economist, not having so much as reviewed his work, the Academician Joseph Bertrand attempted an appreciation of Cournot's method and results. This particular Chapter VII. was specially criticised. Bertrand first gives a general criticism of the *Recherches* in these terms:—

"Si la théorie des richesses de Cournot, malgré la science de l'auteur, la juste considération attachée à sa personne, l'influence de sa situation et le mérite de ses autres écrits, n'a pu, depuis un demi-siècle, attirer sérieusement l'attention, c'est que les idées s'y dérobent sous l'abondance des signes algébriques; la suppression des symboles réduirait le livre à quelques pages, et presque toutes offririaient alors de judicieuses réflexions et des assertions dignes d'intérêt."<sup>1</sup>

Descending to particular criticism, the first mathematician of France undertook to show that Cournot's answers to the above questions were due to a mathematical blunder. Bertrand's own solution of the problem is:—

- (1) There will be no limit to the fall in price;
- (2) The amount of water supplied will reach the amount of satiety, provided the resources of the springs are adequate;
- (3) Equilibrium is impossible.

<sup>1</sup> *Journal des savants*, September, 1883, p. 500.

What, we may ask, becomes of the platitudinous “mathematisch sichere Grundlage” of pure economics?

So far as concerns Bertrand's general criticism that Cournot's symbols mask his ideas, it may be said that, on the contrary, his attempt at symbolic precision precipitated the assumptions tacitly and unconsciously made in ordinary reasoning. Indeed, it is for this very reason that Cournot is taken to illustrate the current fallacy in non-symbolic economics. So far as concerns the particular criticism of the seventh chapter of Cournot's treatise, Bertrand's own conclusions, opposed in every point to those of Cournot, exemplify the paradoxical results that may be reached according to the shifting meaning of competition. Cournot's hypotheses are I., II., V. Bertrand's are I., II., and the negatives of III. and IV. Cournot's error is not a technical mathematical blunder. His conclusions follow rigidly from his premises. To decide between the two series of opposed conclusions, there is alone the test of conformity of the respective premises to reality. Considered from this point of view, there can be no doubt but that Bertrand is nearer the truth. This concession, however, brings home the facts:—

- (1) That the term “competition” undergoes a change of meaning according as competition is between many or a few competitors;
- (2) That there is needed a very careful study of the number of competitors that will render fallacious the usual form of treating economic equilibrium. For example, the value of  $\theta$  in Professor Pareto's equations.<sup>1</sup>

<sup>1</sup> The way Cournot reached his result and the source of his error may be seen from the following: Let there be two competitors producing respectively  $D_1$ ,  $D_2$ , of the commodity.  $D_1 + D_2 = D$ , the whole amount produced. If  $p$  is put for the price of the commodity, then we may write

$$D = F(p), \text{ or } p = f(D) = f(D_1 + D_2).$$

According to hypothesis I., the maximum hypothesis of competition, each producer will independently try to make his income a maximum. Hence

$$D_1 \cdot f(D_1 + D_2), D_2 \cdot f(D_1 + D_2),$$

are two quantities whose maximum value are sought. If now hypothesis V., that

## III.

The criticism will probably be offered that the problem just discussed is extremely hypothetical, and that in reality no such confusion in the use of the term "competition" would occur. Let us, therefore, take up the second proposition in Cournot's Chapter VII., to which reference has already been made. In this case the introduction of the law of cost brings the question nearer reality. The new problem may be stated as follows: If the water of the two mineral springs has a different cost of production to the respective owners, what will be the price of the output as compared with the price under the régime of perfect monopoly and the price under the régime of perfect competition, and what will be the condition of equilibrium? Cournot's solution is:—

- (1) The price will be lower than the monopoly price and higher than the price under a régime of perfect competition.

each producer orders the amount of his output irrespective of the effect of his act upon his competitors, might be used, we should have, according to the mathematical condition of a maximum,

$$(1) \frac{d}{dD_1} [D_1 \cdot f(D_1 + D_2)] = f(D_1 + D_2) + D_1 \cdot f'(D_1 + D_2) = 0$$

$$(2) \frac{d}{dD_2} [D_2 \cdot f(D_1 + D_2)] = f(D_1 + D_2) + D_2 \cdot f'(D_1 + D_2) = 0$$

These two equations may be written in the following form:—

$$(a) D_1 + pF'(p) = 0$$

$$(b) D_2 + pF'(p) = 0$$

By adding (a) and (b), we get

$$(c) F(p) + 2p \cdot F'(p) = 0$$

But, if the production of the commodity had been in the control of a single monopolist, we should have had

$$(d) F(p) + p \cdot F'(p) = 0$$

The root of (c) gives a value of  $p$  smaller than the root of (d). Therefore, it is argued, the result of competition is to lower prices. If the argument is reviewed, it will be seen that the conclusion is dependent upon the use of hypothesis V., and this hypothesis may properly be used only when hypotheses III. and IV. are concurrently true. In the problem before us neither III. nor IV. is true, and, consequently the use of V. is wholly arbitrary and illicit.

This problem has been discussed by Bertrand, *Journal des savants*, 1883, pp. 500-504; by Professor Edgeworth, *Giornale degli economisti*, July, 1897, pp. 20-31; by Professor Pareto, *Cours d'économie politique*, vol. i. pp. 67, 68; by Professor Fisher, *Quarterly Journal of Economics*, January, 1898, p. 126.

- (2) The amount produced will be more than under monopoly and less than under a régime of perfect competition.
- (3) There will be stable equilibrium.

The solution of this second problem is, thus far, identical with that of the first problem, and doubtless seems as platitudeous. But the conclusions are reached by using the same series of hypotheses I., II., V., and the reasoning is invalidated in consequence of the same illicit use of the premise V.

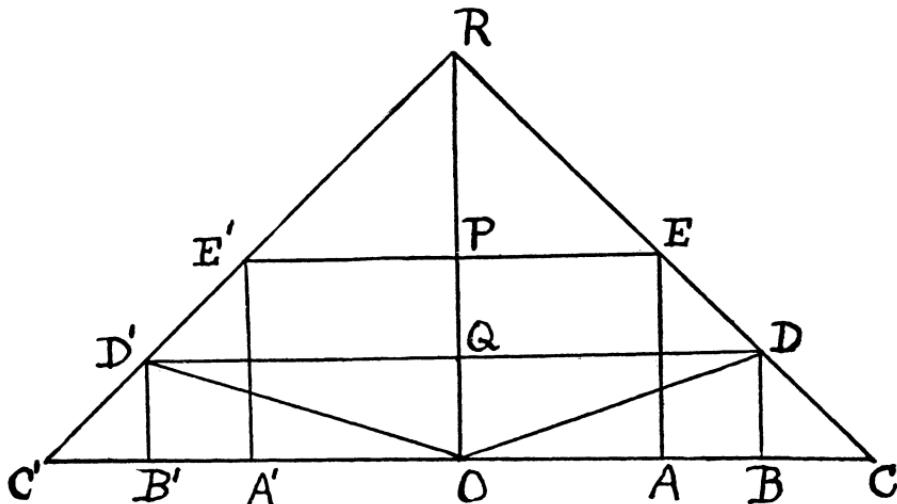
In the discussion of this problem Professor Edgeworth has rendered similar services to those of Bertrand in regard to the first. His conclusion is that the problem is indeterminate; that is, that there are an indefinite number of possible prices and amounts of commodity sold, and that consequently stable equilibrium is impossible.

Professor Edgeworth has succeeded in giving a graphic illustration, which may be reproduced here, of the indeterminateness of equilibrium in case of competing monopolists. The graphic treatment, however, is limited to an extremely simple hypothesis.

Suppose the competing monopolists<sup>1</sup> to be I., II. Suppose, further, (a) that each of the competitors sells to one-half of the consumers, (b) all of the consumers are alike in their desire for the commodity, and in their capacity to pay for it. Their demand curves are, therefore, alike. If we assume that the elementary demand curves may be represented by straight lines, then the demand for the output of I. may be represented by line *RC*, (see the figure) and

<sup>1</sup> The expression "competing monopolists," when employed in relation to a single commodity, seems a contradiction in terms, but its use has the sanction of Professor Edgeworth, whose investigations of monopoly are the most important contributions to exact economics since the work of Cournot. The distinction between competition, perfect competition, monopoly, perfect monopoly, rests upon a quantitative basis, and the odd sounding of "competing monopolists" in the above context is doubtless partly due to the lack of analysis of the terms in popular economics.

the demand for the output of II. by  $RC^1$ . In both cases the amount of commodity is measured on the axis of abscissas and the price upon the axis of ordinates. (c) The law of cost is the same for the two competitors, and may be represented by  $OD$ ,  $OD^1$ . It is further supposed, in the diagram, that the amount of possible output of each producer is limited to  $OB$ ,  $OB^1$ , which in each case is equal to three-fourths of  $OC$ .  $OC$  is drawn equal to  $OR$ .



Upon these conditions it may be proved that, if the two producers acted as a unit, the price  $OP$ , which is one-half of  $OR$ , would be settled upon as affording the maximum net revenue. If, however, the price  $OP$  were to obtain, there would be an advantage for either producer—for example, I.—to throw upon the market any amount of product intermediate between  $PE$  and  $QD$  at a price less than  $OP$  by an amount as small as he pleased. Such a course on the part of I. would draw off a large part of the purchasers of II., thereby diminishing the latter's net profit. It would, therefore, be to the advantage of II. to throw upon the market any amount intermediate between  $PE^1$

and  $QD^1$  at a price less than the price fixed by *I.*, by an amount as small as he pleased. This underselling might continue until the price  $OQ$  were reached and the amount  $OB + OB^1$  were sold. But the movement of price need not stop here. If the price  $OQ$  were reached, then it would be to the advantage of either producer, say of *I.*, to limit the amount of his output to  $PE$  or to an amount intermediate between  $PE$  and  $QD$ . *II.*, following his own advantage, would limit his output, and so the process would continue. Under the conditions of the problem there could be no resting-place.<sup>1</sup>

The case just presented is intended simply to illustrate the phenomenon of indeterminateness. Professor Edgeworth has treated the general problem analytically in a way in which the conditions imposed, unlike those given above, are conditions approximating reality.

This second problem of Cournot's, owing to the introduction of the consideration of cost, has a keener interest for us than the preceding one. The contradictory results of the two investigators throw a new light on the doctrine that, under competition, the laborer gets what he produces. If we accept Cournot's method of treating the problem,—the method of projecting the process of reasoning applicable to unlimited competition into the field of limited competition,—we reach the conclusion that the more industry falls into the hands of a few competitors, the higher the price of the commodity, the narrower the opportunity for remunerative employment of labor. The theory that labor gets what it produces becomes the theory that his production is limited to the condition of maximum profit of his employer. And this is true, no matter how keen may be the degree of competition of employers. If we accept the criticism of Professor Edgeworth, which sets out from premises much nearer to the conditions of

<sup>1</sup> *Giornale degli economisti*, July, 1897, pp. 23, 24.

actual life, the problem is economically indeterminate, rates are fixed by non-competitive causes, and the doctrine that labor gets what it produces becomes the doctrine that labor at least produces what it gets.

#### IV.

Let us return for a moment to Cournot's second problem. As far as that problem has been treated, nothing extraordinary has appeared in his conclusions. Indeed, it seems probable that Cournot accepted his own results (1) because they seemed to be in harmony with common observation that competition reduces prices ("comme on est bien convaincu avant toute analyse, le résultat de la concurrence est d'abaisser les prix" (p. 94), (2) because they are in harmony with the doctrine of continuity which is fundamental in his general philosophy.<sup>1</sup> There would seem to be much in favor of conclusions deduced by mathematical method, confirmed by common experience and the philosophic doctrine of continuity.

It is very fortunate that the reasoning here is expressed in mathematical form, Bertrand's criticism notwithstanding; for there is less chance of dragging in new conditions, as is usually done when conclusions of economic reasoning are controverted. The very same equations that yield the three results above given, which seemed so commonplace, will also yield the following:—

*The producer of the greater amount of water, in case there are two producers, will have a marginal cost less than that of the producer of the less amount.*<sup>2</sup> In his discussion of this problem Cournot places no limitation upon the laws of cost, whether they are the laws of diminishing return, con-

<sup>1</sup> Compare his *Essai sur les fondements de nos connaissances*, vol. i., chap. xiii. Perhaps in no other system of philosophy is the doctrine, and even the phrase *natura non facit saltus*, of more frequent occurrence.

<sup>2</sup> Cournot, *Recherches*, p. 96.

stant return, or increasing return.<sup>1</sup> If the three platitudeous conclusions are accepted because they are deduced from Cournot's equations and confirmed both by a vague common experience and the philosophic doctrine of continuity, then we must also be prepared to at least follow the consequences of the above deduction from his equations.

Suppose the production of the water is subject to the law of diminishing return at both of the springs. We should then have the following paradox: In case of perfect competition, when the law of diminishing return is the law of production, the price of the product is equal to the marginal cost of production. In case of competition, when the law of diminishing return is the law of industry, the price of the product is greater than the marginal cost, and the marginal cost is less for the producer of the greater amount.

Or, if we take industry subject to the law of increasing return, we have this paradox:—

In case of perfect competition, equilibrium is impossible.<sup>2</sup> In case of competition there is stable equilibrium, price is greater than the marginal cost, and the producer of the greater amount has the lower marginal cost!

Cournot seems to have been the first to state the doctrine that equilibrium is impossible where industry is subject

<sup>1</sup> Suppose the laws of cost to the two competitors are symbolized respectively by  $\phi_1(D_1)$ ,  $\phi_2(D_2)$  where  $D_1$ ,  $D_2$ , have the same meanings as in a previous note. Then according to hypothesis I., if  $p = f(D_1 + D_2) = f(D)$ , the competitors will independently seek the maximum values respectively of  $[f(D) \cdot D_1 - \phi_1(D_1)]$ ,  $[f(D) \cdot D_2 - \phi_2(D_2)]$ . If hypothesis V. might be used, we should have, by the condition of a maximum,

$$(1) f(D) + D_1 \cdot f'(D) - \phi'_1(D_1) = 0$$

$$(2) f(D) + D_2 \cdot f'(D) - \phi'_2(D_2) = 0$$

Subtracting equation (2) from equation (1), we have

$$D_1 - D_2 = \frac{1}{f'(D)} [\phi'_1(D_1) - \phi'_2(D_2)] = F'(p) [\phi'_1(D_1) - \phi'_2(D_2)].$$

Here  $F(p) = D$ , and consequently  $F'(p)$  is always negative. Therefore  $D_1 \gtrless D_2$  according as  $\phi'_1(D_1) \lesssim \phi'_2(D_2)$ . Observe that in the treatment of the problem no restrictions are placed upon the signs of  $\phi''_1(D_1)$ ,  $\phi''_2(D_2)$ .

<sup>2</sup> *Recherches*, p. 102.

to the law of increasing return, and yet the above paradox—or is it an absurdity?—flows from his equations.

Professor Marshall's animadversions upon the method of treating this problem are most illuminating for the following reasons:—

(1) They lead to his showing that the statical method is inadequate to deal with problems of increasing return. “The hypothesis of a stationary state is useful to illustrate many points in economics; but it is the nature of such hypotheses to be treacherous guides, if pursued far away from the starting-point. They soon lead us into a region of unreal abstractions, and, in particular, this one is not suitable for that part of the pure theory of equilibrium of normal demand and supply . . . which relates to industries that obey the Law of Increasing Return, a law that belongs essentially to an age of change and progress.”<sup>1</sup>

Accordingly, we find that nearly all manuals adopting the statical method of exposition make no mention of the law of increasing return. Or, if perchance the law is referred to, no hint is given of the nature of the modifications of the results previously deduced before they may be applied to industries subject to the law of increasing return.

(2) They lead to the illuminating mathematical Note XIV. in the Appendix to his *Principles*, in which a precise definition is offered of the term “marginal product of labor.” From Notes III. and XIV. of the Appendix the following proposition may be deduced: The error of regarding the marginal product of labor as equal to the physical product of a unit of labor multiplied by the price per unit of the product is greater (a) the greater the proportion of the total output supplied by a producer, (b)

<sup>1</sup> *Principles*, 2d edition, pp. 484, 485. That the above was suggested by Cournot's problem may be seen by referring to the note, p. 485, of the same edition.

the less the degree of elasticity of demand for the product. In a word, the term "marginal product of labor" also changes its meaning according as the number of competing producers are many or few.

## V.

The paradoxes thus far considered have been derived from the common theory of the supply of rival commodities. The case about to be discussed concerns the theory of complementary commodities, and will still further exemplify the fallacy of projecting methods of reasoning relative to a given state of industry and a given set of implicit hypotheses into an unexplored territory. Cournot's *Recherches* will again form the starting-point of the investigations. In the ninth chapter of that work the following problem is proposed: If to the making of a given commodity two factors of production are necessary, what is the condition of equilibrium, of the price of the commodity, and of the amount of the commodity supplied, when the factors of production are severally monopolized instead of being under the control of the maker of the finished good?

Cournot's solution is:—

- (1) The price will be higher than the price under a single monopoly.
- (2) Less will be produced than in the case of a single monopoly.
- (3) Equilibrium will be stable.

The way of reaching these extraordinary conclusions is described explicitly by Cournot, p. 114: "On applique à la théorie du concours des producteurs les raisonnements qui nous ont servi à analyser les effets de la concurrence." He confessedly follows the method of reasoning, dear to

the hearts of economists and sociologists, of arguing by analogy. In case of the supply of rival commodities, each producer competes for a part of the supply, and, by hypothesis V., orders the amount of his output without regard to the effects of his act upon the output of his competitors. In case of the supply of complementary commodities, each producer competes for a part of the price of the finished good, and alters the price of his own factor without regard to the effect of his act upon the prices of the factors of his competitors. Cournot's mathematics in this particular problem are based upon this analogy, and his conclusions are relative to these premises.

Suppose his analogy and conclusions are accepted. Then, by a not uncommon use of the term "competition," we find that, in case of complementary goods, the competition of factors of production, severally monopolized, for a share of the price of the finished good, leads to an increase of the price of the finished good over the price that would obtain under a single monopoly. The amount of the product is diminished, the field for the remunerative employment of labor is reduced, and wages fall. If these results are true, what becomes of the remedy for the evils of monopoly in the form of competition?

If objection is made to Cournot's propositions, the reply is offered that he simply followed the custom of economists of arguing by analogy, projecting the conclusions relative to one state of industry into another state, using a part of the hypotheses covered by the term "competition," and neglecting the rest.

When the premises of this particular problem are brought nearer to the facts of actual industry,—*e.g.*, by Professor Edgeworth in his articles in the *Giornale degli economisti*,—it is found that here again the problem is indeterminate and rates are fixed by non-competitive causes.

The chief object of this paper has been to show some of the critical limitations of the current method of investigating economic questions, and to expose the bewildering vagueness of a fundamental term. Incidentally, certain statements have been made with regard to the theory that, as wages, the laborer gets what he produces. In order that these scattered statements may be brought together, and a view obtained of the extremely hypothetical character of that theory, a summary in a categorical form may be made:—

1. The doctrine that the laborer gets what he produces does not apply in case of perfect monopoly; and there are no statistics as to the proportion of industry actually monopolized.
2. The doctrine does not apply when the producers of a commodity are few in number. The current method of investigation, which leads to the projection of conclusions based on perfect competition into this field of competing monopolists, is fallacious. There are no statistics as to industries in this condition.
3. The doctrine needs serious modification in case of industries subject to the law of increasing return. The statical method is inadequate to deal with the problem. There are no statistics as to the proportion of industry in this state.
4. The doctrine does not apply in case of the monopoly of one or more complementary producers' goods. The projecting of the method and results of perfect competition into this field leads to most absurd conclusions. There are no statistics as to the proportion of industry in this state.

“*Bien loin d'avoir songé à écrire dans un esprit de système et pour me ranger sous les bannières d'un parti, je pense qu'il reste un pas immense à franchir pour passer de la théorie aux applications gouvernementales; je*

trouve que la théorie ne perd rien de son prix, en restant ainsi préservée du contact de la polémique passionnée; et je crois que si cet essai pouvait être de quelque utilité pratique, ce serait principalement en faisant bien sentir tout ce qui nous manque pour résoudre, en pleine connaissance de cause, une foule de questions que l'on tranche hardiment tous les jours.”<sup>1</sup>

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<sup>1</sup> Cournot's *Recherches*, p. xi.